PATENT ABSTRACTS OF JAPAN

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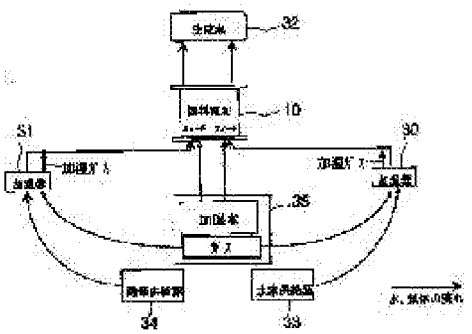
(54) CONTROL METHOD IN OPERATION STOP FOR FUEL CELL

(57)Abstract:
PROBLEM TO BE SOLVED: To provide a control method in operation stop for a fuel cell, capable of preventing deterioration of a metal separator by a method which is different from covering layer forming.
SOLUTION: (1) This control method in operation stop of the fuel cell, having a separator 18 in which at least the surface is made of metal makes a humidifying fluid 35 flow through at least an anode gas passage 27 of reactant gas passages 27, 28 of the separator 18 for the specified time, from soon after the operation of the fuel cell is stopped. (2) The humidifying fluid is humidifying gas. (3) The humidifying fluid is humidifying water.



DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention]Especially this invention relates to the control method at the time of the shutdown of a solid polyelectrolyte type fuel cell, concerning the control method the time of the shutdown of a fuel cell.
[0002]
[Description of the Prior Art]the electrode (an anode.) which consists of the catalyst bed and diffusion zone which have been arranged at the whole surface of the electrolyte membrane which a solid polyelectrolyte type fuel cell becomes from an ion-exchange membrane, and this electrolyte membrane with the film-electrode assembly (MEA:Membrane-Electrode Assembly) which consists of an electrode (a cathode, an air pole) which consists of the catalyst bed and diffusion zone of a fuel electrode and an electrolyte membrane which were alike on the other hand and have been arranged. an anode and a cathode -- fuel gas (it is also called anode gas usually hydrogen) and oxidizing gas (it is also called cathode gas.) A cell is constituted from a separator which forms oxygen and the reactant gas channel for usually supplying air, Laminate two or more cells, consider it as a module, laminate a module, and a module group is constituted, It consists of what was fixed to the cell laminating direction both ends of a module group in the fastening member (for example, tension plate) which arranges a terminal, an insulator, and an end plate, constitutes a stack, binds a stack tight, and is prolonged in a cell laminating direction on the outside of a cell layered product. In a solid polyelectrolyte type fuel cell, in the anode side. The reaction which uses hydrogen as a hydrogen ion and an electron is performed, a hydrogen ion moves the inside of an electrolyte membrane to the cathode side, and the reaction which generates water from oxygen, a hydrogen ion, and an electron (the electron generated with the anode of the next MEA lets a separator pass) is performed in the cathode side.

anode side: -- $H_2 \rightarrow 2H^+ + 2e^-$ cathode side: -- from it being required for there to be an electrolyte membrane in a $2H^+ + 2e^- + (1/2)\ O_2 \rightarrow H_2O$ hydrogen ion moving the inside of an electrolyte membrane to the cathode side at a damp or wet condition. In fuel cell operational status, anode gas and cathode gas are usually supplied in the state of humidification gas through a humidifier, and the both sides of MEA are in humidification atmosphere continuously. In a fuel cell shutdown state, supply of anode gas and cathode gas is stopped and the surface of a separator will be in the state where it got dry. And the chloride by the remainder of acid in the acid eluted from MEA, i.e., the drug solution used at the time of catalyst support, and the chlorine contained in exhaust air out of the atmosphere, etc. condense at the time of fuel cell shutdown, and cause a local pH decrease. Use of the metal separator is considered for the weight saving of a fuel cell, and low-cost-izing. In a metal separator, the local silverfish of a metal separator, corrosion, and degradation arise due to the local pH decrease produced at the time of fuel cell shutdown, and fuel cell performance falls by this local metal degradation. JP,2000-21419,A is indicating the metal separator.
It is indicating forming the enveloping layer for corrosion prevention in the surface of a metal separator.

[0003]
[Problem(s) to be Solved by the Invention]However, there was a problem that it was accompanied by a cost hike in the deterioration prevention of the fuel cell metal separator by the conventional enveloping layer formation for corrosion prevention. Enveloping layer formation is a different method and the purpose of this invention is to provide the control method at the time of the shutdown of a fuel cell which can prevent degradation of the metal separator of a fuel cell.
[0004]

[Means for Solving the Problem]This invention which attains the above-mentioned purpose is as follows.
(1) It is the control method at the time of shutdown of a fuel cell which has a separator with which the gas-passageway surface consists of metal at least, and is the control method from immediately after shutdown of a fuel cell at the time of shutdown of a fuel cell which pours a humidification fluid to an anode gas channel at least of predetermined time and a reactant gas channel of said separator.
(2) It is the control method at the time of shutdown of a fuel cell given in (1) said given humidification fluid is humidification gas.
(3) It is the control method at the time of shutdown of a fuel cell given in (1) said given humidification fluid is humidifying water.
[0005]At the time of shutdown of a fuel cell of the above (1), in a control method. Since a humidification fluid is poured from immediately after shutdown of a fuel cell in an anode gas channel even if there are few predetermined time and reactant gas channels of a separator, Even if acid (chloride etc.) by chlorine etc. which were taken in out of acid (for example, sulfuric acid, nitric acid, etc.) eluted from MEA during fuel cell operation or the air remains in the surface of a reactant gas channel of a metal separator at the time of fuel cell shutdown, Acid is flushed with a humidification fluid and discharged out of a stack with a humidification fluid. As a result, fuel cell performance degradation by degradation by acid of a metal separator and degradation is prevented. Since adhesion of acid on the surface of reactant gas of a metal separator poses a problem in an anode gas channel rather than a cathode gas channel which is having the surface washed with waterdrop which produced water arises and moves by prudence during fuel cell operation, suppose that a humidification fluid is passed to an anode gas channel at least. However, it may pass also to a cathode gas channel. At the time of shutdown of a fuel cell of the above (2), by a control method, since a humidification fluid is humidification gas, gas supplied over predetermined time at the time of fuel cell shutdown can be humidified using a humidifier for humidifying reactant gas at the time of fuel cell operation. At the time of shutdown of a fuel cell of the above (3), by a control method, since a humidification fluid is humidifying water (for example, pure water), compared with a case of humidification gas, predetermined time of humidification fluid supply can be managed in a short time, can flush acid efficiently, and can discharge it out of a stack. Since humidifying water is discharged out of a stack and is not enclosed in a stack, metal deterioration prevention by acid is measured more nearly thoroughly.
[0006]
[Embodiment of the Invention]Below, the control method is explained with reference to drawing 1 - drawing 4 at the time of the shutdown of the fuel cell of this invention. The fuel cell with which the control method is applied at the time of the shutdown of the fuel cell of this invention is the solid polyelectrolyte type fuel cell 10. The solid polyelectrolyte type fuel cell 10 is carried, for example in a fuel cell electric vehicle. However, it may be used in addition to a car.
[0007]the electrode 14 (an anode.) which consists of the catalyst bed 12 and the diffusion zone 13 which have been arranged at the whole surface of the electrolyte membrane 11 which consists of ion-exchange membranes, and this electrolyte membrane 11 as the solid polyelectrolyte type fuel cell 10 is shown in drawing 1 - drawing 3the electrode 17 (a cathode.) which consists of the catalyst bed 15 and the diffusion zone 16 of a fuel electrode and the electrolyte membrane 11 which were alike on the other hand and have been arranged The film-electrode assembly (MEA:Membrane-Electrode Assembly) which consists of air poles, the electrodes 14 and 17 -- fuel gas (anode gas, for example, hydrogen) and oxidizing gas (cathode gas.) For example, a cell (cell 29) is formed for the separator 18 which forms the refrigerant passage 26 through which oxygen, the reactant gas channels 27 and 28 (the fuel gas flow route 27 and the oxidizing gas passage 28) for usually supplying air, and the refrigerant for fuel cell cooling (usually cooling water) flow in piles, Carry out the plural laminates of this cell, consider it as the module 19, laminate the module 19 and constitute a module group, and arrange the terminal 20, the insulator 21, and the end plate 22 to the cell laminating direction both ends of module 19 group, and the stack 23 is constituted to them, It consists of the fastening member 24 (for example, tension plate) which binds the stack 23 tight to a cell laminating direction, and is prolonged in a cell laminating direction on the outside of a cell layered product, and a thing fixed with the bolt 25.
[0008]In this invention example, the separator 18 of the solid polyelectrolyte type fuel cell 10 is a separator (the separator with which the gas-passageway surface consists of metal at least is hereafter called metal separator) with which the gas-passageway surface consists of metal at least. The metal separator 18 may comprise what piled up the metal plate (for example, stainless plate) with unevenness of two or more sheets, or as long as the metal plate is arranged on the surface (field exposed to a reactant gas channel), it may comprise what piled up the metal plate and the resin board. A metal plate is not coated with the enveloping layer for antioxidizing, but direct contact of the metal plate is carried out to reactant gas.

[0009]At the time of the shutdown of the fuel cell of this invention example, the control method, As shown in drawing 4, it is the control method at the time of the shutdown of the fuel cell 10 which has the metal separator 18, It consists of the control method at the time of the shutdown of the fuel cell which pours the humidification fluid 35 to the anode gas channel 27 at least of the predetermined time from immediately after the shutdown of the fuel cell 10, and the reactant gas channels 27 and 28 of the separator 18.
[0010]When pouring the humidification fluid 35 to the anode gas channel 27, the humidification fluid 35 may be poured also to the cathode gas channel 28. The humidification fluid poured in the anode gas channel 27 and the humidification fluid poured in the cathode gas channel 28 may be fluids of the same kind, and may be a fluid of a different kind. The time when the humidification fluid 35 is poured should just be more than time to flush the acid which has adhered to the reactant gas channels 27 and 28 of the metal separator 18 at the time of fuel cell shutdown with the humidification fluid 35, and discharge it out of a stack, or it. Therefore, the humidification fluid is not enclosed in the stack all the time from fuel cell shutdown to the next operation resumption.
[0011]The humidification fluid 35 may be humidification gas, or may be humidifying water. In the case of humidification gas, a humidifier is humidified and supplied through gas (for example, exhaust air etc.). In the humidifier which humidifies the gas supplied to the anode gas channel 27 and the cathode gas channel 28 at the time of fuel cell shutdown. The humidifiers 30 and 31 which humidify the anode gas from the anode gas (for example, hydrogen) supply source 33 and the cathode gas from the cathode gas (for example, oxygen, exhaust air) supply source 34 at the time of fuel cell operation may be used. In the case of humidifying water, humidifying water (for example, pure water, pH 7) is supplied directly, without not letting it pass to the anode gas channel in a stack at the time of fuel cell shutdown, but letting it pass in a humidifier in a cathode gas channel. After humidification gas and humidifying water pass along the inside of a stack, they are discharged out of a stack, but the discharge path 32 (for example, produced water discharge path) of the moisture of the anode gas channel 27 at the time of fuel cell operation and the cathode gas channel 28 can be used for a discharge path.
[0012]Below, an operation of the control method is explained at the time of the shutdown of the fuel cell of this invention example. During fuel cell operation, the anode gas channel 27 in the back stack by which the anode gas (hydrogen) from the anode gas supply source 33 was humidified through the humidifier 30 is supplied. The cathode gas (exhaust air) from the cathode gas supply source 34 is supplied to the cathode gas channel 28 in the back stack humidified through the humidifier 31. And a power generation reaction is performed within a stack and water is generated by the cathode. Since an anode and a cathode are in a humidified state by humidification gas during fuel cell operation and a cathode is in a humidified state more with produced water, Since it does not condense and is always washed by fall by prudence of waterdrop, even if acid is eluted from MEA or acid arises with chlorine in supply exhaust air, etc., The metal separator 18 does not cause the corrosion by acid, and it is not generated or is hard to produce the battery capacity fall by elution of a metal ion.
[0013]Since supply of anode gas and cathode gas is stopped at the time of fuel cell shutdown, desiccation of moisture and concentration of acid take place conventionally, but. In this invention, since humidification gas or humidifying water is supplied to the anode gas channel 27 at least ranging from the time of fuel cell shutdown to predetermined time, desiccation of the reactant gas channels 27 and 28 and concentration of acid (sulfuric acid, nitric acid, chloride, fluoric acid, etc.) do not arise, and it does not become low pH environments. Since acid of the metal separator 18 surface is flushed by the flow of the fall by prudence of the waterdrop produced from humidification gas, or humidifying water and is discharged out of the stack 23, concentration of acid does not arise and it does not become low pH environments. The corrosion of the metal separator 18, elution of the metal ion by this corrosion, and a battery capacity fall do not arise, or these results are hard to produce. In this case, the reason it was presupposed that is passed to the anode gas channel 27 at least is that it is hard to dry the cathode gas channel 28 after shutdown since produced water arises during fuel cell operation. However, when fear of desiccation of the cathode gas channel 28 is after shutdown, a humidification fluid may be supplied also to the cathode gas channel 28.
[0014]Since the humidification in the case of supplying humidification gas should just use anode gas and the humidifiers 30 and 31 for cathode gas humidification, most things which the burden on equipment increases do not have it. When supplying humidifying water, compared with the case of humidification gas, the reactant gas channels 27 and 28 can be carried out in a short time at a damp or wet condition, and washout of acid can be performed efficiently. The above-mentioned metal separator deterioration prevention is performed without forming an enveloping layer in the metal separator surface, and the case where an enveloping layer is formed does not become expensive. By supplying a predetermined time humidification fluid after fuel cell shutdown,

MEA is humidified, and a possibility that the electrolyte membrane 11 is maintained at the damp or wet condition also at the time of operation resumption is high, and can carry out the response of the power generation at the time of operation resumption early in that case.

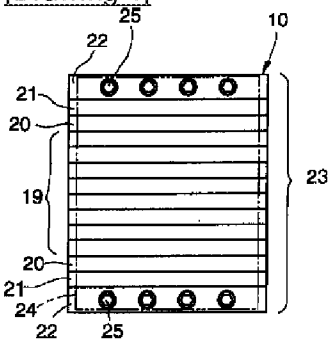
[0015]

[Effect of the Invention]Since a humidification fluid is poured from immediately after the shutdown of a fuel cell in an anode gas channel according to the control method at the time of the shutdown of the fuel cell of claim 1 even if there are few predetermined time and reactant gas channels of a separator, Even if acid (chloride etc.) by the chlorine etc. which were taken in out of the acid (for example, sulfuric acid, nitric acid, etc.) eluted from MEA during fuel cell operation or the air remains in the surface of the reactant gas channel of a metal separator at the time of fuel cell shutdown, Acid is flushed with a humidification fluid and discharged out of a stack with a humidification fluid. As a result, the fuel cell performance degradation by degradation by acid of a metal separator and degradation is prevented. Since a humidification fluid is humidification gas at the time of the shutdown of the fuel cell of claim 2 according to the control method, the gas supplied over predetermined time at the time of fuel cell shutdown can be humidified using the humidifier for humidifying reactant gas at the time of fuel cell operation. Since a humidification fluid is humidifying water (for example, pure water) at the time of the shutdown of the fuel cell of claim 3 according to the control method, compared with the case of humidification gas, the predetermined time of humidification fluid supply can be managed in a short time, can flush acid efficiently, and can discharge it out of a stack.

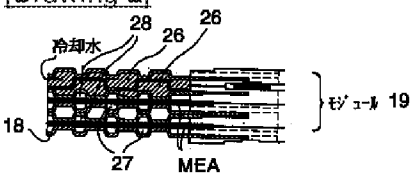
[Translation done.]

DRAWINGS

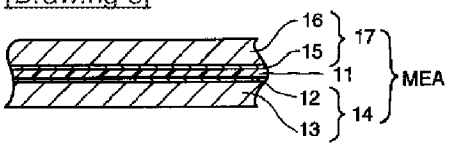
[Drawing 1]



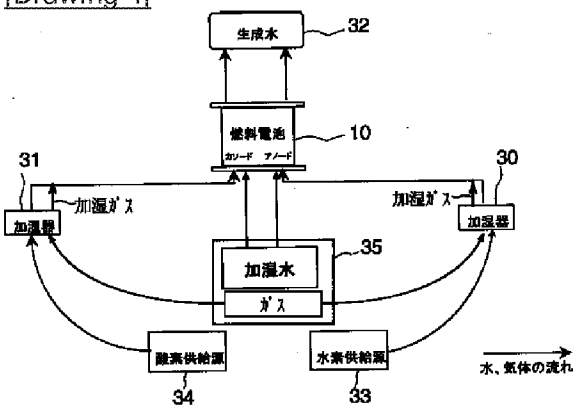
[Drawing 2]



[Drawing 3]



[Drawing 4]



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